



Standards for Mathematical Practice

Helping English Learners Become Proficient in Math through Language.



Premise

- English Learners bring linguistic and cultural repertoires as well as other assets to learning a second language.
- Access cannot be achieved without considering both the needs and strengths English Learners bring to the classroom.



Classroom Language

- Involves interactions between teacher, students, and other adults in a variety of formats that include communication between individuals in pairs (one-to-one) or small groups (one-to-group), by students or teachers with the entire class (one-to-many), and by students with various written materials through oral, written, and multimodal communication.



Explore Language

- Solve the problem on the next three slides.
 - Work with another when this is appropriate for your learning, work alone when that is best for you.
 - When finished, share your results with others in your group or at your table.
 - How do your results compare? Are they similar? If so, how? Are they different? If so, how?
 - How does language affect the way you approach the task, the way you listen to others discuss the task and the way you write or speak about the task?

Feeding Mannie



- Mannie is a show dog. Marco, his owner, wants him to have a beautiful and brilliant coat. The vet suggested a special diet for Marco to follow. Each feeding, Manny eats $\frac{1}{3}$ of a can of wet dog food, $\frac{1}{8}$ of a bag of dry dog food, and $\frac{1}{2}$ a patty of special meat. The special meat comes in a package of 6 patties. Manny has two meals a day.



Poor Manny!

- The dog is completely out of food. Marco goes to the store and buys 24 cans of wet food, 4 bags of dry food and 3 packages of meat.
- How many days will the dog be fed before Marco needs to buy any more food?
- Which type of dog food will Marco run out of first? Explain.
- How much of the other two types of dog food will be left after the first type of dog food runs out?

Mannie



- Marco wants to plan better. He goes to the store on the day he ran out of the first type of dog food. He decides to buy enough dog food to last 90 days. Knowing what he already has in the house, how much more of each type of dog food does he need to buy in order to use up all the food in 90 days? Is it possible? Explain.
- What is the minimum amount of food Marco could buy on the day that he ran out such that the dog would finish all of it after a certain number of meals? Explain.



Discuss Solution

1. First with a partner, discuss your solution to this task. Include your thoughts about how language affects the way you approached the task.
2. Discuss with another small group.
3. Share out with the whole group.

Standards for Mathematical Practice



- 1. Make sense of problems & persevere in solving them**
2. Reason abstractly & quantitatively
- 3. Construct viable arguments & critique the reasoning of others**
4. Model with mathematics
5. Use appropriate tools strategically
- 6. Attend to precision**
7. Look for & make use of structure
8. Look for & express regularity in repeated reasoning.

Language Functions Associated with the SMP



- Analytical Tasks
- Receptive Language Functions
- Productive Language Functions



Analytical Tasks

- Outline the intellectual activities in which students engage.
 - If you are analytical, you are good at taking a problem or task and breaking it down into smaller elements in order to solve the problem or complete the task.

ANALYTICAL



Language Functions

- What the students do with language to accomplish the content tasks.
 - Receptive Language: the ability to understand & comprehend what is being said or read.
 - Productive Language: the ability to communicate orally & in writing.





SMP through an EL Lense

- The tables we are about to explore define in detail these practices by outlining the language functions that ELLs need to engage with mathematics content.
- You and a partner will be given cards with factors from these tables for Language Proficiency for either Analytical Tasks, Receptive Language Functions or Productive Language Functions for MP1, MP3, & MP6. Discuss the following:
 1. Did you engage in the behavior reflected on your cards?
 2. How would you ensure that your students engaged in this behavior?
- Be prepared to discuss this with the whole group.

MP1



- Analytical Tasks:
 - Explain to self a problem's meaning, look for entry points to solution, & plan solution pathway.
 - Monitor effectiveness of current selected solution strategy & decide when to pursue a different solution strategy.
- Receptive Language Functions:
 - Comprehend the meaning of a problem as presented in multiple representations, such as spoken language, written texts, diagrams, drawings, tables, graphs, & mathematical expressions or equations.
- Productive Language Functions:
 - Create, label, describe, & use in presenting solutions to a math problem multiple written representations of a problem.

MP3



- Analytical Tasks:
 - Make conjectures & build logical progression of statements to explore truth of conjectures specifies units of measure.
 - Make plausible arguments taking into account context from which data arose.
- Receptive Language Functions:
 - Comprehend others' talk about math problems, solutions, approaches, & reasoning.
- Productive Language Functions:
 - Comprehend oral & written concepts, procedures, or strategies used in arguments & reasoning, including:
 - Present information, description of solutions, explanations, & arguments to others.
 - Ask questions about others' solutions, strategies, & procedures for solving problems.

MP6



- Analytical Tasks:
 - Refine communication about mathematical reasoning & objects so that it increasingly becomes more mathematically precise (e.g., uses clearer definitions of terms, explicitly states the meaning of symbols used, specifies units of measure).
 - When appropriate, communicate precisely with others about mathematical reasoning & objects (e.g., use clear definitions of terms, state meaning of symbols used, specify units of measure, label visual representations, & make claims that apply to a precise set of situations).
- Receptive Language Functions:
 - Comprehend the meaning & features of precision of definitions, symbols meanings, units of measure, & visual representations as presented in multiple representations (e.g., texts, diagrams, & visual media).
- Productive Language Functions:
 - Communicate with precision (orally, in writing, & through other representations) about claims & arguments related to precision: Specify units of measure.



Premise & Conclusion

- Premise
 - English Learners bring linguistic and cultural repertoires as well as other assets to learning a second language.
 - Access cannot be achieved without considering both the needs and strengths English Learners bring to the classroom.
- Conclusion
 - The combination of mathematical practices and grade level content standards raises expectations for students' comprehension and production when explaining abstract concepts and relationships, which often include a blend of visual models, text, and talk.



“The rewards of effective discourse are many. Not long ago, I was observing students work out a problem together. When they finally "got" it, one of the students exclaimed, "We are so smart." Isn't that what we are striving for? Not "the teacher is so smart," not "they are so smart," but "we are." In that statement, I heard both confidence and community. Healthy discourse promotes these things.’

-- Cynthia Lanius, Project teacher